

MAGNETITE ANODES FOR IMPRESSED CURRENT CATHODIC PROTECTION SYSTEMS

MAGNETITE (Fe_3O_4) is a natural mineral with good conductivity and a high degree of oxidation that makes it resistant to corrosion even at high temperatures. When alloyed with small quantities of other minerals under controlled conditions, an anode with the optimal electrochemical properties and mechanical strength is produced.

Our magnetite anode is casted in hollow cylindrical forms to minimise weight and to facilitate cable to anode connections at the centre of the anode. This centre cable to anode connection allows for a uniform current dissipation at the anode surface.

The surface of the anode in the hollow centre is lined with a layer of lead of thickness and length to provide highly reliable current conduction between cable connector and anode.

The hollow annular space is filled with a dielectric compound after the cable connection is made and the ends of the anode are sealed with anode caps to prevent ingress of foreign matter.

SPECIFIC FEATURES

- Operates at high current densities.
- Extremely low dissolution.
- Not susceptible to ripple in d.c. supply.
- No ceiling on d.c. voltage output.
- Light weight and easy to install, remove for inspection and reinstall.
- Centre cable to anode connection for even current distribution and consumption of anode surface.

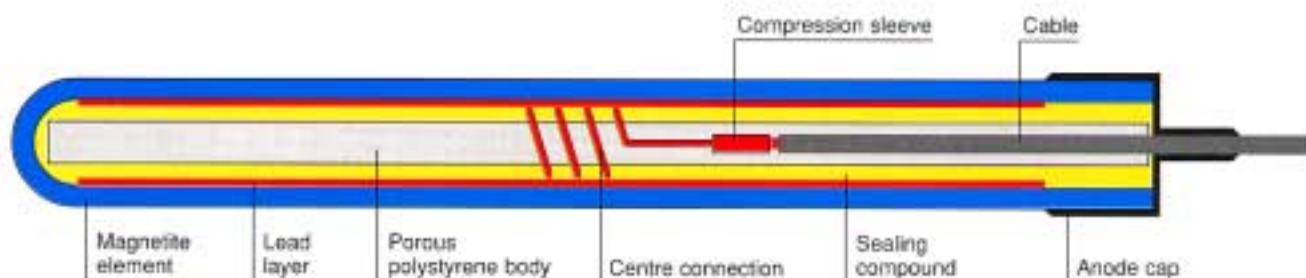
THE NEW MILLENNIUM MAGNETITE ANODES

HIGHLIGHTS

The magnetite anode performance has, throughout the years, been tested and confirmed by SMT and several independent research laboratories as well as technical analysts and has proven to be one of the most reliable anode materials.

QUALITY & VALUE ADDITIONS

- Independent series of examinations and selections of castings for the making of the anodes.
- The selection of anode caps and lead materials according to customers specifications and environmental conditions, is based on experience.
- Impregnable anode cap connections with corrosion resistant material and a special welding process.
- Special electrical resistance and potential tests to confirm uniform current dissipation without hot spots.
- Controlled sealing of anode hollow annular space with selected dielectric compound.
- A full range of accessories for easy installations, inspections and replacements according to customers specified requirements and environmental conditions.
- Independent examination of anodes before packing.
- Free consultation for anode selections and design.



Specific gravity	4.7-4.8	kg/dm ³
Brinell hardness (WB5/187.5/15)	344	
Bending strength	5	kN/cm ²
Density	4.71	g/cm ³
Melting point	1500	°C
Coefficient of linear expansion	6.4x10 ⁻⁶	1/°C (0-100°C)

FeO	28 - 32%
Fe ₃ O ₄	60 - 64%
Balance	4 - 12%

Consumption rate	0.02 kg/A year
Current density ¹⁾	0.70 mA/dm ²
Efficiency	90%

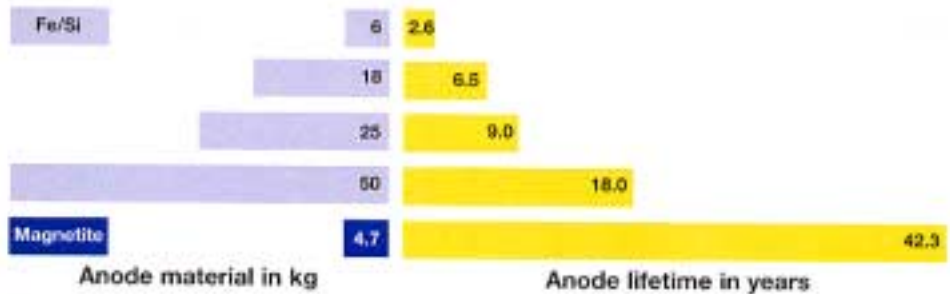
¹⁾ depends on environment

Lifetime comparison - Basis: anode current load 5 A

Chlorine containing soil

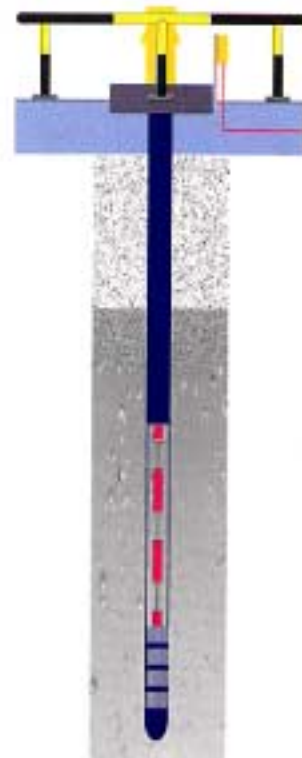


Seawater and deep groundbeds



Magnetite anodes under extreme operating conditions

Location:	Desert	
Protected objects:	Oil well casings	
Type of anodes:	MA - CHAIN	
Installation:	Deep groundbeds	
Type of groundbed:	Open hole	
Electrolyte:	Brackish water	
Water temperature:	45°C	
Typical water analysis		
after 3 months of operation	ph-value:	0.85
	Sodium:	6000 mg/l
	Calcium:	1500 mg/l
	Magnesium:	600 mg/l
	Chloride:	8000 mg/l
	Sulfate:	2600 mg/l
	Total dissolved solids:	16000 mg/l
Number of groundbeds:	312	
Number of anodes:	4900	
Current load per anode:	4A	
Operating time since:	1988	
Anode consumption after 5 years:	10 - 14%	



TYPE: MA - U

Diameter	60 mm
Total length	720 mm
Effective length	670 mm
Total weight	6.0 kg
Min. effective mass	4.7 kg
Surface area	13.4 dm ²
Max. current load	3.0 A



Surrounding electrolyte:
neutral soil and water
without chlorine and sulfate
content

Applications:
shallow groundbeds,
deep groundbeds

TYPE: MA - CS

Diameter	60 mm
Total length	760 mm
Effective length	710 mm
Total weight	6.0 kg
Min. effective mass	4.7 kg
Surface area	13.4 dm ²
Max. current load	6.0 A



Surrounding electrolyte:
chlorine and/or sulfate
containing soil or stagnant
water

Applications:
shallow groundbeds,
deep groundbeds

TYPE: MA - SEA

Diameter	60 mm
Total length	760 mm
Effective length	710 mm
Total weight	6.0 kg
Min. effective mass	4.7 kg
Surface area	13.4 dm ²
Max. current load	16.0 A

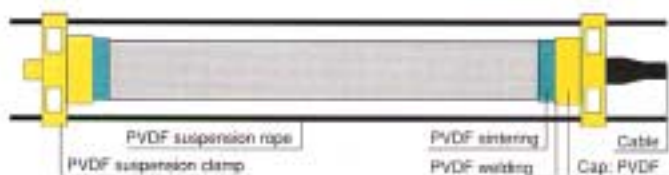


Surrounding electrolyte:
flowing seawater or
brackish water

Applications:
platforms, jetties,
harbours

TYPE: MA - CHAIN

Diameter	60 mm
Total length	740 mm
Effective length	600 mm
Total weight	6.2 kg
Min. effective mass	4.7 kg
Surface area	11.3 dm ²
Max. current load (groundbeds)	6.0 A
Max. current load (tanks)	16.0 A



Surrounding electrolyte:
chlorine containing soil or
stagnant water

Applications:
deep groundbeds open
hole, deep groundbeds
closed hole, water tanks

CANISTER FOR MA - U + MA - CS

COKE BACKFILL

Minimum carbon content	90 %
Maximum moisture content	5 %
Maximum resistivity	1Ωm
Density	700-950 kg/m ³
Particle size (dia.)	20 mm max.



Standard canister	Diameter (mm)	Length (mm)	Total weight (kg)
CAN 10	150	1000	60
CAN 15	300	1500	85
CAN 20	300	2000	110